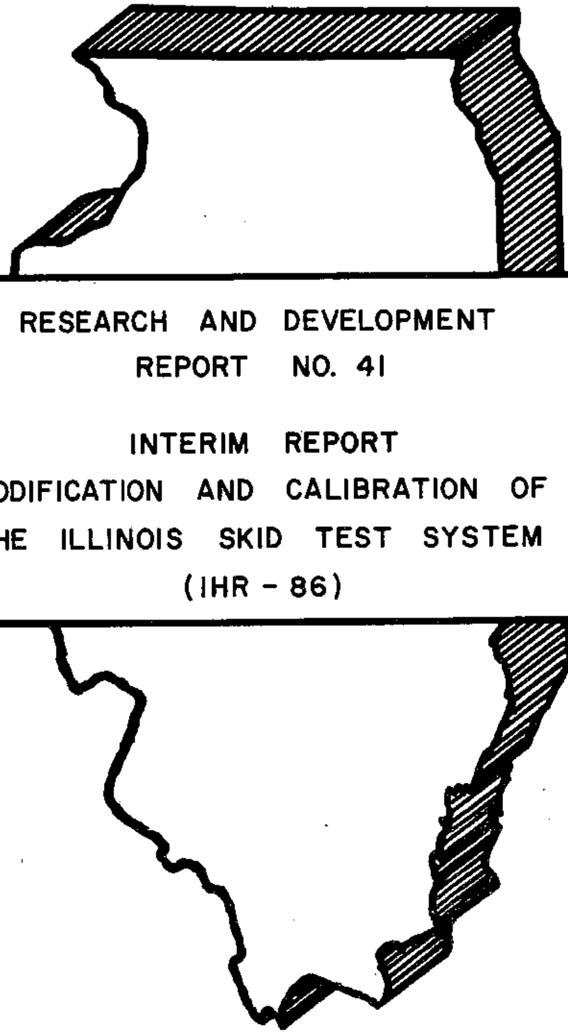
STATE OF ILLINOIS

DEPARTMENT OF TRANSPORTATION



# RESEARCH AND DEVELOPMENT REPORT NO. 41

# INTERIM REPORT
# MODIFICATION AND CALIBRATION OF THE ILLINOIS SKID TEST SYSTEM
# (IHR - 86)

SPRINGFIELD, ILLINOIS 62764 — APRIL 1972

State of Illinois
DEPARTMENT OF TRANSPORTATION
Bureau of Research and Development

INTERIM REPORT
IHR-86
SKID RESISTANCE OF PAVEMENT SURFACES

# MODIFICATION AND CALIBRATION OF THE ILLINOIS SKID TEST SYSTEM

by

E. J. Kubiak, P. G. Dierstein, and F. K. Jacobsen

A Research Project Conducted by
Illinois Department of Transportation
in Cooperation with
U.S. Department of Transportation
Federal Highway Administration



April 1972

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16. Abstract

Skid-test equipment was designed according to the applicable parts of ASTM Designation: E 274-65T, Tentative Method of Test for Skid Resistance of Pavements Using a Two-Wheel Trailer, and construction of the equipment was awarded to a commercial fabricator. After delivery, several modifications were made to improve the overall performance of the original equipment, and calibration procedures were established to insure the reliability of the system. Tests performed with three different methods of water application showed system details and method of water application to have a very significant effect on the magnitude of measured skid resistance and a brush-type applicator to be most effective in depositing a water layer of both uniform width and thickness directly in the path of the test tire. The results of the tests suggest a need for establishing a standard method for water application and control of the cross-sectional dimensions of the water layer before a meaningful correlation can be made among the variety of skid trailers now in existence.

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# INTRODUCTION

This is the second report on the development and calibration of test equipment by the Illinois Department of Transportation for determining the skid resistance of highway pavements. The total effort is part of a research project, "An Investigation of Skid Resistance of Pavement Surfaces," undertaken in cooperation with the Federal Highway Administration of the U. S. Department of Transportation.

A previous publication, Research and Development Report No. 23, "Selection and Design of a Skid Tester," describes in detail the design and fabrication of the original equipment. A brief description of these activities is repeated in the present report for convenience.

The system, consisting of a skid trailer and tow vehicle, was designed in accordance with the criteria established by the tentative standards of ASTM Designation: E 274-65T, Skid Resistance of Pavements Using a Two-Wheel Trailer. Fabrication of the equipment was awarded to Soiltest Incorporated of Evanston, Illinois. The trailer and tow vehicle were delivered to the Illinois Division of Highways in May 1968, and with certain modifications the system was made operational in July 1969.

The design of the original equipment was based on a review of available information regarding systems in use by various agencies throughout the country. At that time, a large variation in the design of existing skid trailers was evident, and little uniformity was found between designs. A decision was made to include those design features which the experience of others had shown to be adequate or had at least indicated promise in providing satisfactory results.

It was realized that certain features would be experimental, and that modifications for improving the equipment would be necessary in the final development of an operational system. Therefore, a decision was made to incorporate modifications whenever improvement seemed appropriate.

After receiving the equipment, preliminary tests were performed to evaluate the operational characteristics of the system and to qualify the apparatus as a device suitable for measuring skid resistance of pavements. Several problems were encountered during the preliminary testing which indicated an immediate need for modifying certain components of the equipment before considering the system operational. The major modifications included: (1) conversion of the electrically powered water pump to a mechanically driven system for maintaining a uniform water flow rate; (2) conversion of the direct discharge wetting nozzles to brush applicators for producing a more uniform water film thickness; and (3) revisions of the recording system for improving the stability of the signal conditioning equipment.

During the preliminary tests, procedures also were implemented for calibrating the force measuring and watering systems. The procedures include: (1) calibration of the force transducers by the torque or lever-arm method for correlating skid numbers to readings obtained from the force measuring system; and (2) calibration of the watering system to establish the flow rate of the water discharged on the pavement surface.

This report describes the skid-test equipment in general, the modifications made in the equipment, and the procedures established for calibrating the major components of the system. Skid tests were performed using three different methods of water application which included both nozzle and brush applicators. Visual observations made during the tests clearly indicated that the brush applicators dispersed a more uniform water layer which more nearly approaches the theoretical

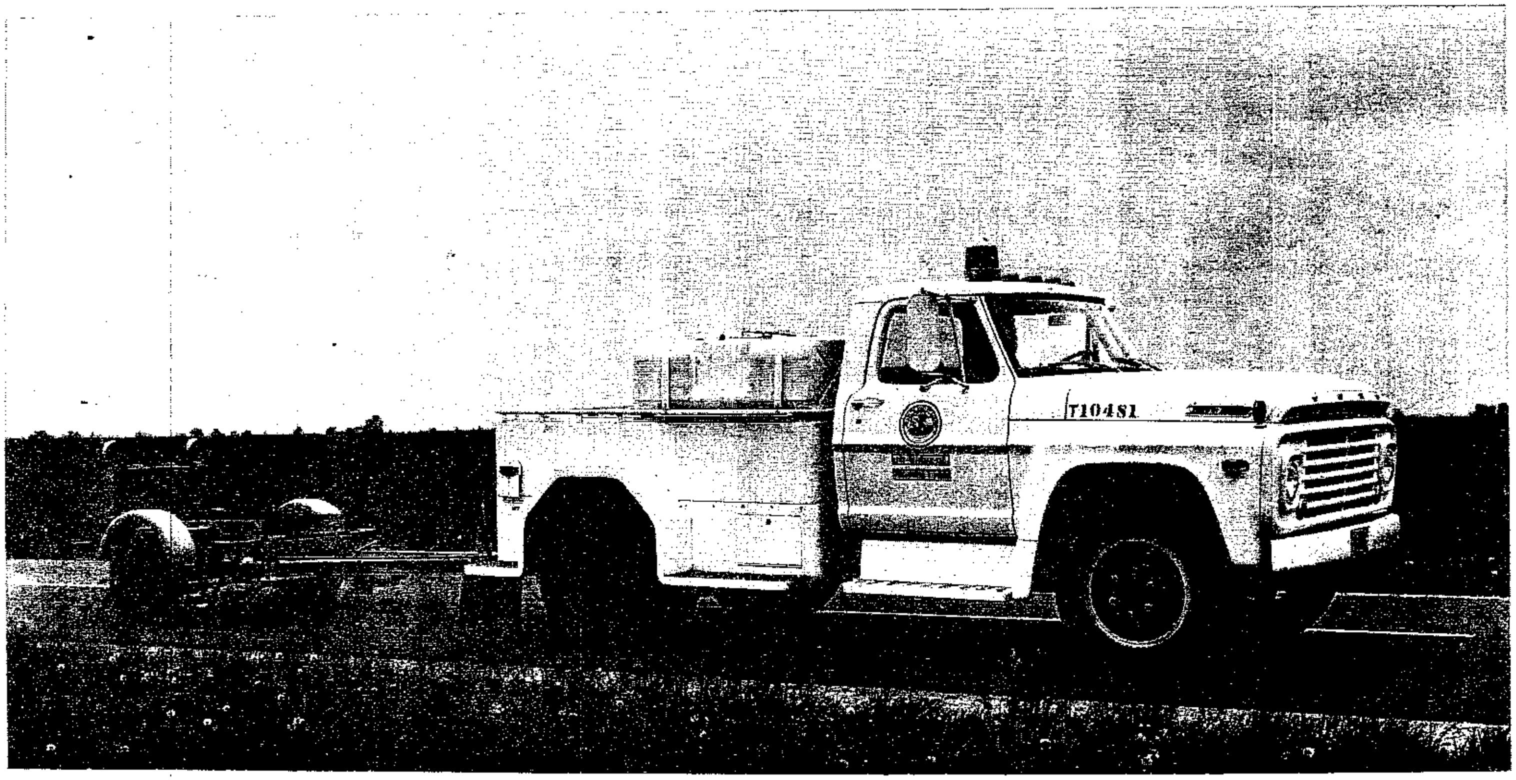



Figure 1. Tow truck and skid-test trailer.

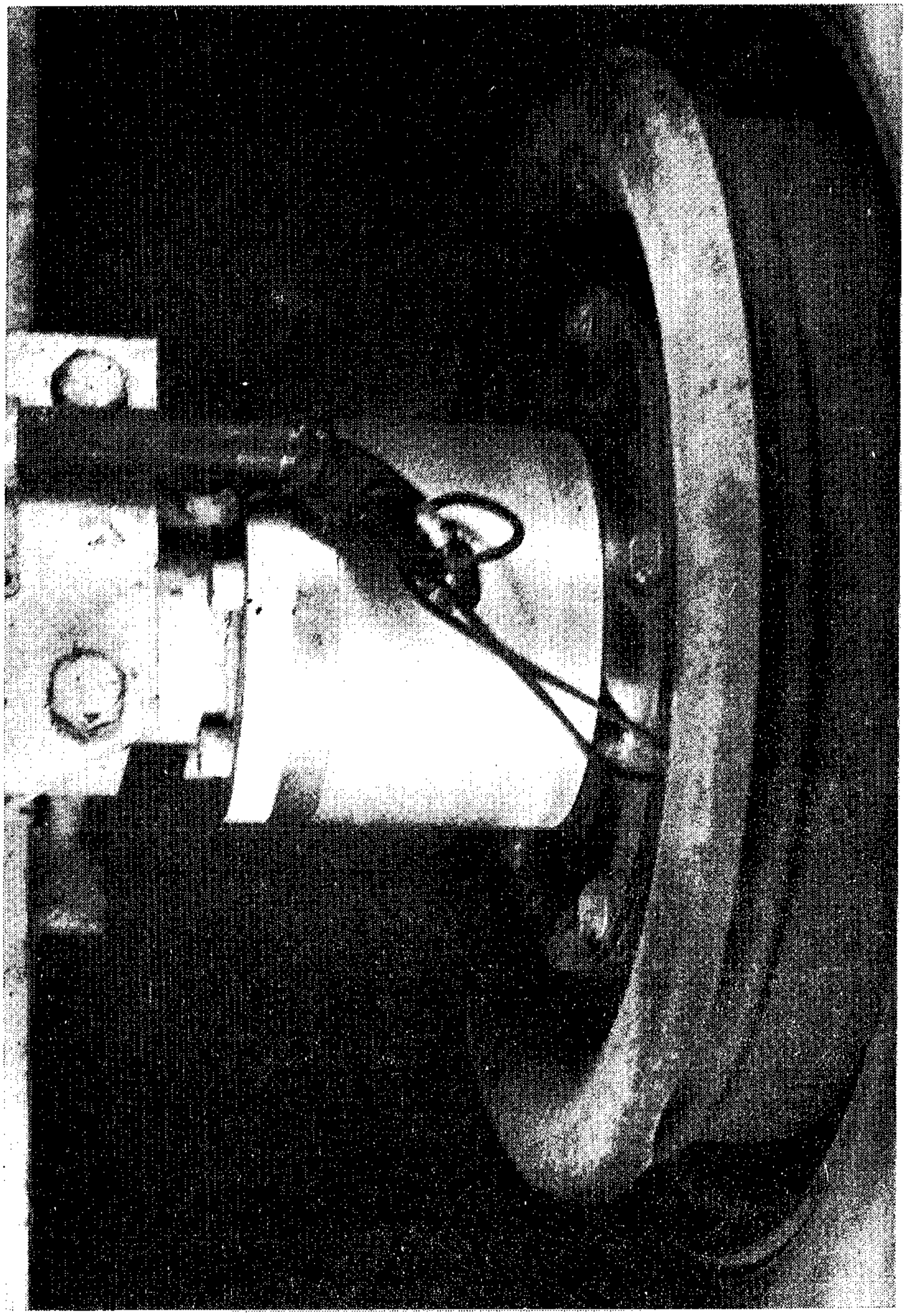


Figure 2. The torque-transducer.

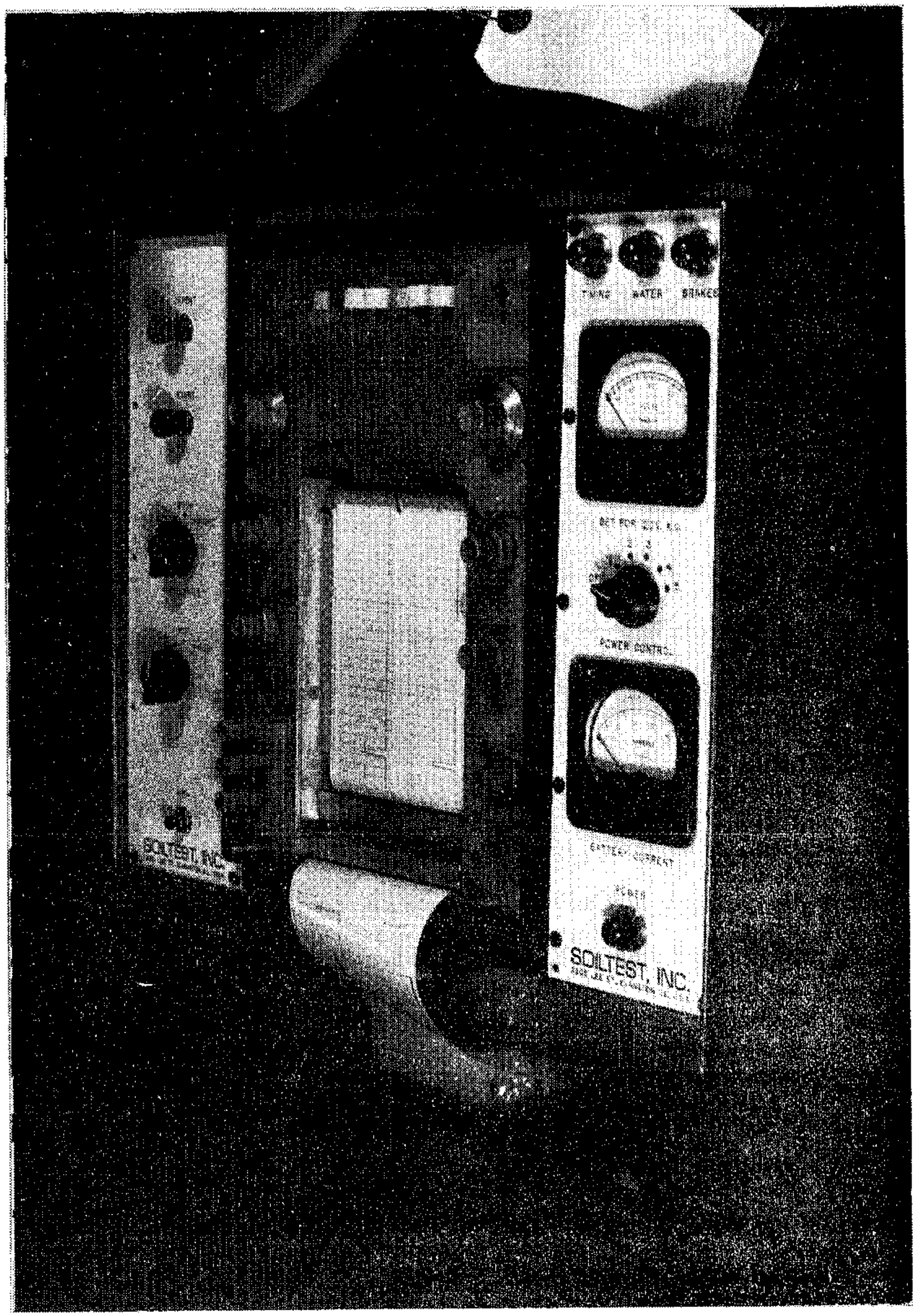



Figure 3. The recording console.

after some usage. Representatives of the Warner Brake Company, when informed of this problem, expressed the opinion that the brakes possibly were being operated at or near their design limit. Replacement of the brake armature and magnet to part numbers 1101-11-003 and 1101-631-014 respectively, to provide a much greater locking capability, was suggested. This modified brake has performed adequately and is now used as standard equipment for the trailer.

Watering System

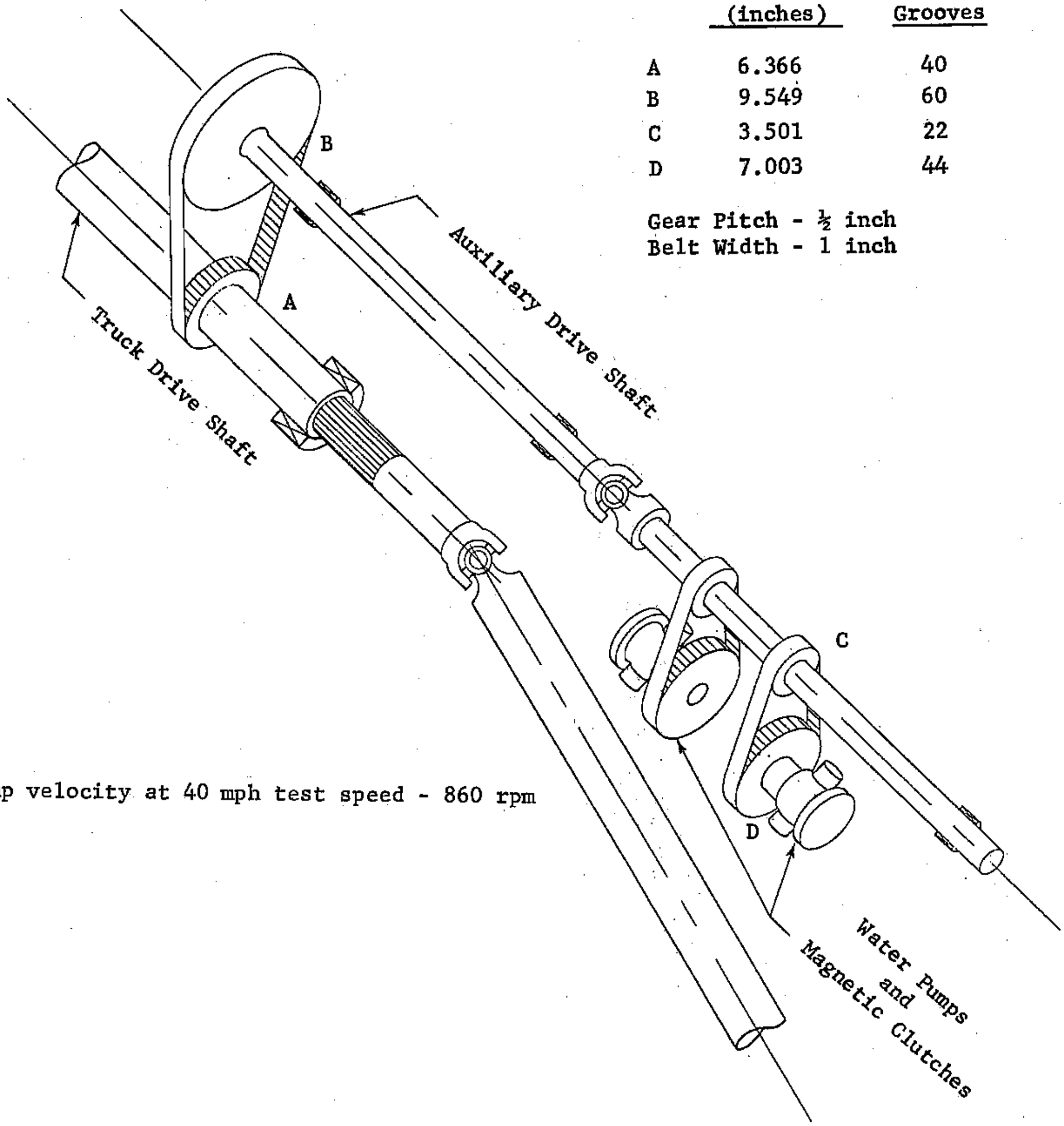
The self-watering system of the skid-test equipment consists primarily of the supply tank, pumps, distribution lines, and applicator assembly.

Preliminary testing of the original equipment showed that the water application system was inadequate for maintaining a constant water flow rate and for dispensing a water layer comparable to the cross-sectional dimensions used in computing the required discharge rate. The major problems were: (1) the output rate varied with battery condition; (2) the proper flow rate could not be maintained when switching from a one-wheel test to a two-wheel test; (3) the flow rate was not easily adjustable for different test speeds; and (4) the water, when applied to the pavement, tended to splash and scatter far beyond the width of the tread path.

The original watering system included a pump which was driven by an electric motor powered by the 12-volt electrical system of the truck. The power requirements for this motor exceeded the output of the existing alternator and, as a result, the truck battery would discharge during testing. As the battery discharged, the water flow rate fell below that required to produce the ASTM minimum thickness requirements. To eliminate the variance of the water flow rate caused by variations in the condition of the battery, the single electrically driven pump was replaced by two pumps mechanically driven by the drive shaft of the truck (Figures 4 and 5).

| | Gear Pully Diameter (inches) | Number of Grooves |
|---|---|---|
| A | 6.366 | 40 |
| B | 9.549 | 60 |
| C | 3.501 | 22 |
| D | 7.003 | 44 |

Gear Pitch - ½ inch
Belt Width - 1 inch




Pump velocity at 40 mph test speed - 860 rpm

Figure 4. A schematic of the mechanical drive for the water pumps.

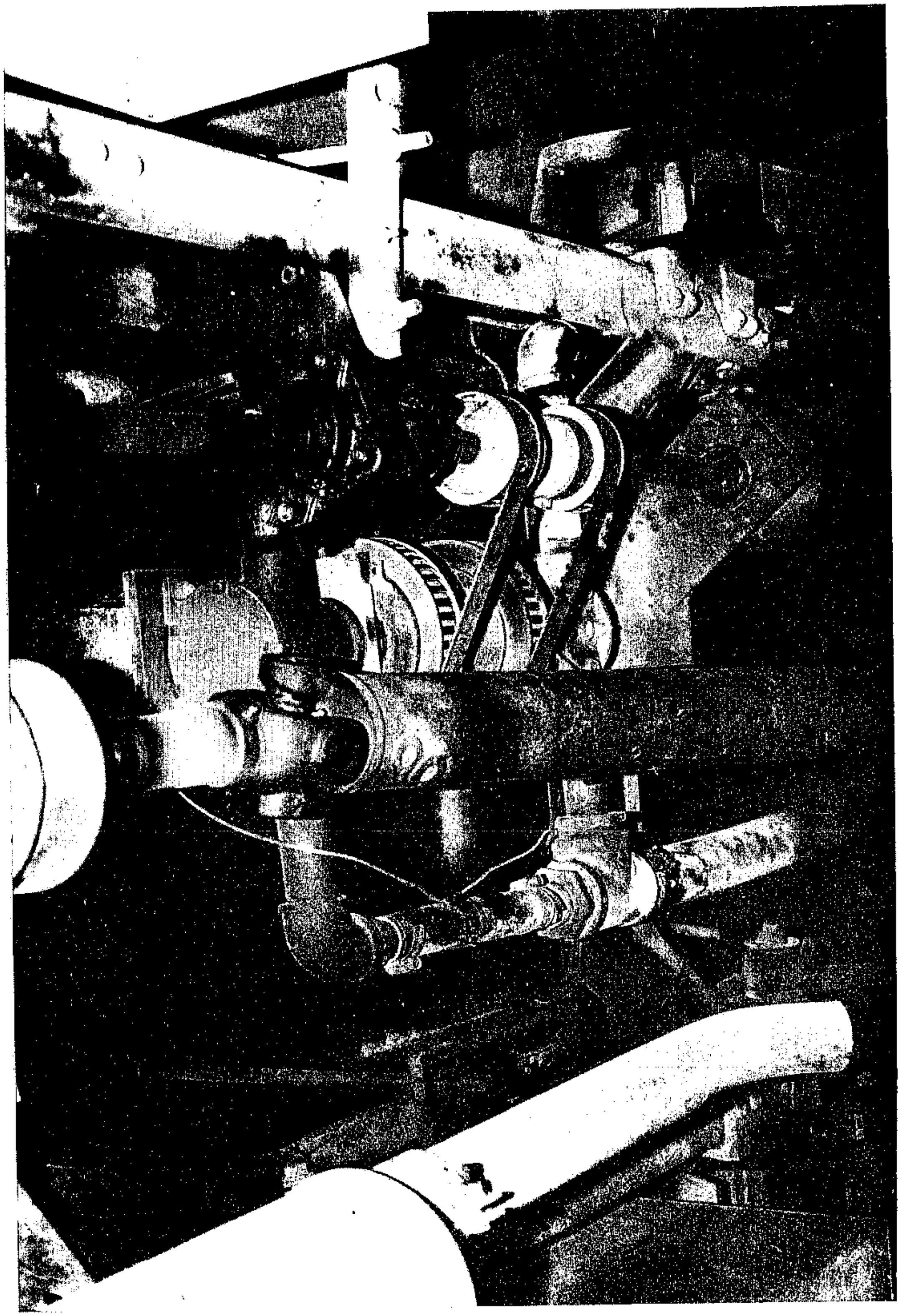


Figure 5. A view of the mechanical drive for the water pumps.

These two pumps are Jabsco Model 6400 positive-displacement pumps having a maximum rated capacity of 69.0 gpm at 2100 rpm when operating with the back pressure of 4.3 psi.

An auxiliary shaft with an assemblage of rubber gear belts and gear pulleys powered by the drive shaft is used to drive the two water pumps (Figures 4 and 5). The use of the gear belt arrangement eliminates slippage to insure a more uniform water flow during each test. After converting the pumps to a mechanically driven system, the drive shaft was balanced to reduce vibrations within the system. This conversion has provided satisfactory service for over 50,000 miles of operation with no major mechanical problems developing as a result of the modification.

Each water pump is controlled by a magnetic clutch located between each water pump gear pulley and the water pump shaft. Because the water pumps are positive displacement and the gear belt drive eliminates the problem of belt slippage, the rate of water flow is directly dependent upon the speed of the drive shaft and the gear ratio selected to give the proper water output. With this new arrangement, the water flow rate is proportional to the speed of the truck.

A pressure sensitive valve, which is spring-loaded, was installed in each of the discharge lines to keep the water from draining out of the lines between tests. An adjustable valve also was provided at the brush applicators to regulate the back pressure of the water for lowering the brush to the pavement. By controlling the back pressure, the valve is also capable of regulating to a slight degree the discharge rate of the water to the brushes.

ASTM Designation: E 274-65T specifies a water layer thickness of 0.020 $\pm$ .005 in. for all test speeds. This thickness cannot be measured directly and is calculated from the width of the water trace on the pavement and measured values of water flow rate. The cross-section of the trace is assumed to be of uniform thickness in the calculation. Because of the non-uniform trace deposited by most wetting systems due to the turbulence of the water as it leaves the nozzle and strikes the pavement surface, a reasonable measurement of the trace width is not readily obtainable. In most cases, the value for the trace width used in the computations is only an estimate based on visual or photographic observations. Furthermore, the assumption of uniform cross-section thickness may be very inaccurate.

The skid trailer, as received from the fabricator, was equipped with a nozzle-type water applicator designed to place a stream of water onto the pavement in an area immediately in front of each tire. Observations of the wetting system indicated considerable water scatter and lack of cross-sectional uniformity in application at normal test speeds (Figure 6). As a result, difficulty was experienced in determining both the width and thickness of the water film deposited under the test tires by the system.

To reduce the observed inconsistencies, the system was modified to accommodate a brush applicator which places the water directly on the pavement (Figure 7). The trailing edge of the brush is located approximately 23 inches from the center of the tire. The manner of applying the water is fully automatic with the brushes lowered to the pavement by the water back pressure acting on a hydraulic piston (Figure 8). Rubber baffle plates were also attached to the sides of the brush to further reduce the problem of water scatter (Figure 9). The brushes used for the wetting system, which were purchased from the Fuller Brush Company, are identified as Model Number 326. This brush was selected because its design offered the least restriction to the flow of water passing through the top of the brush. The durability

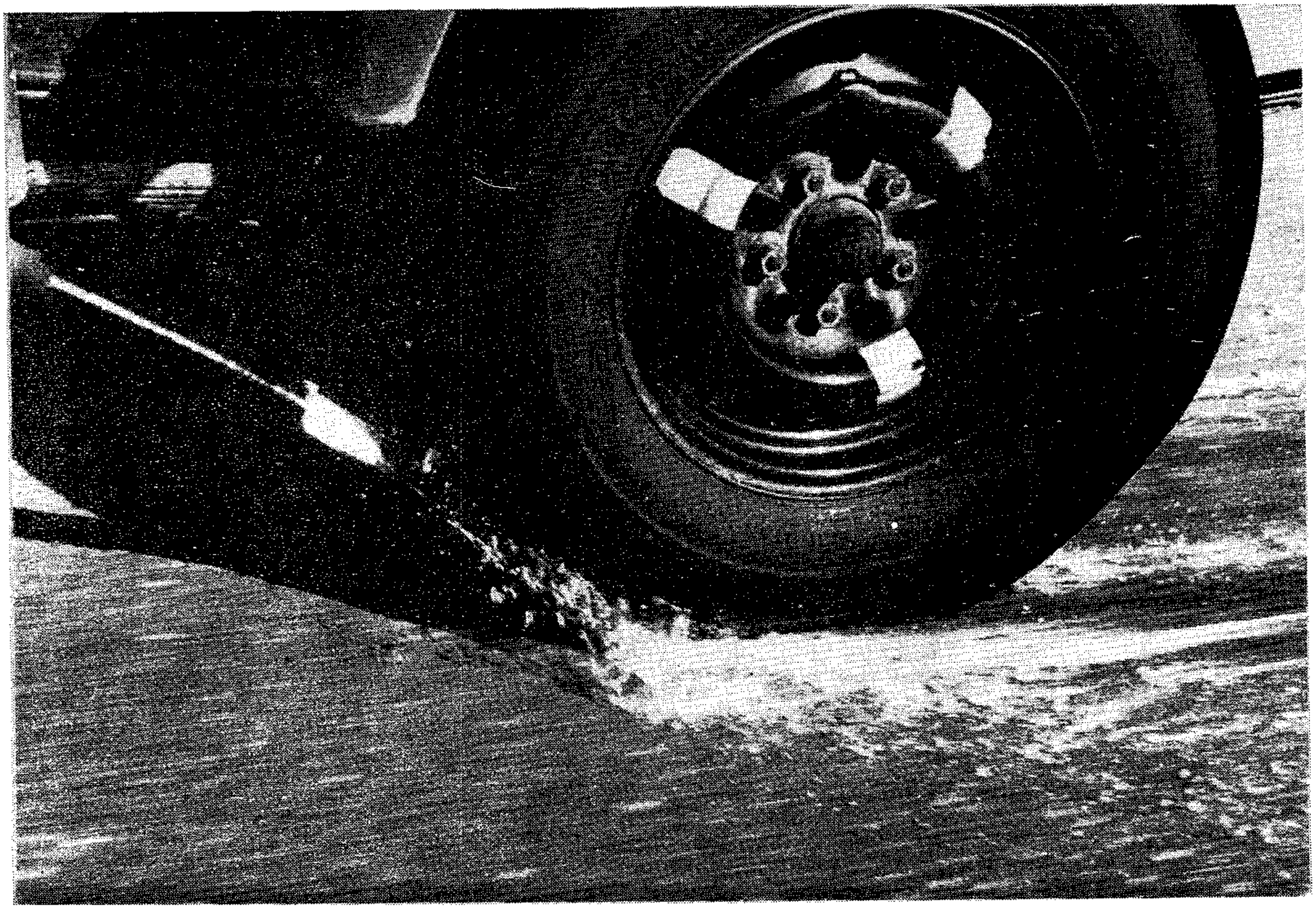


Figure 6. Watering system with water applied by nozzle.

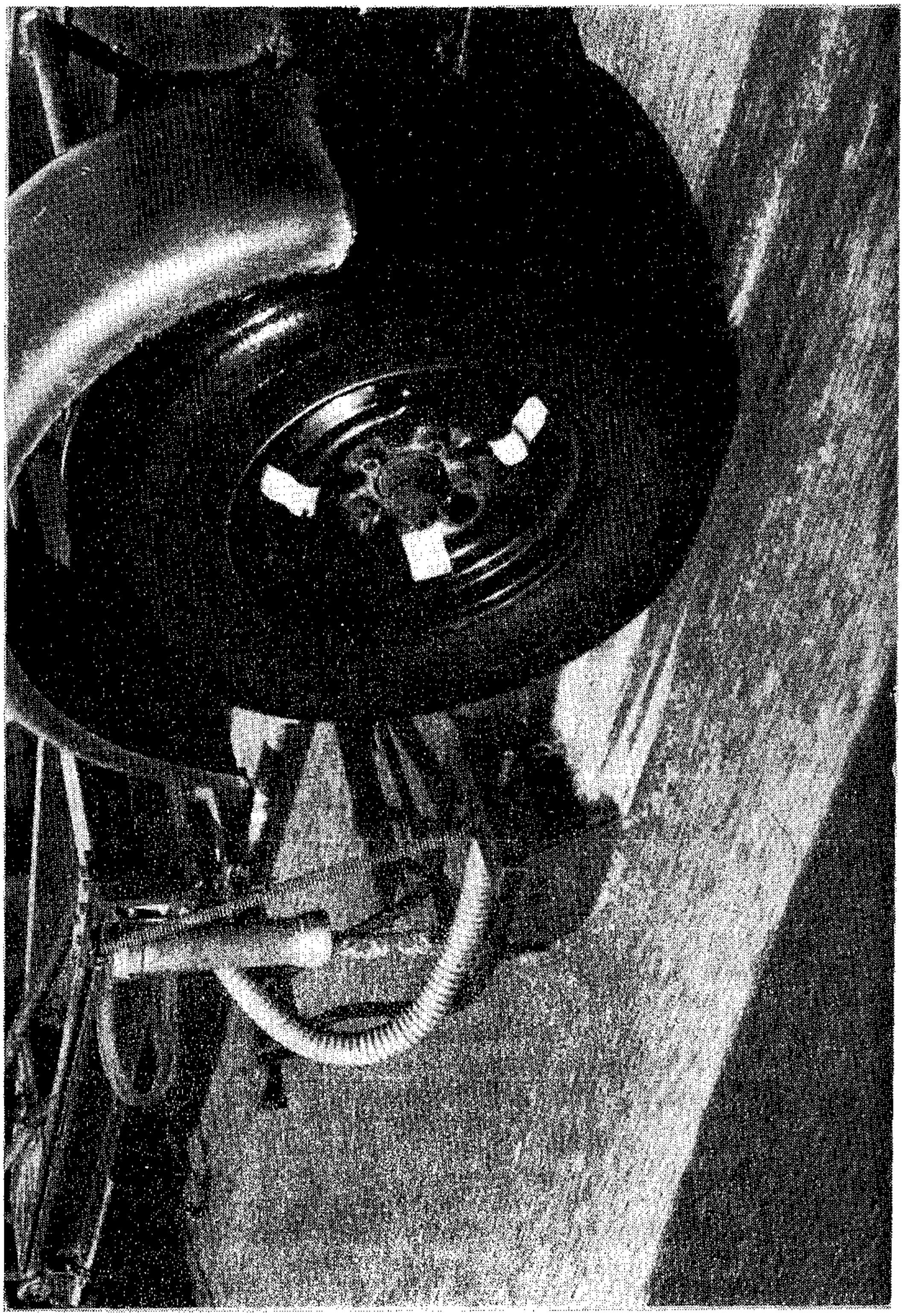


Figure 7. Watering system with water applied by brush.

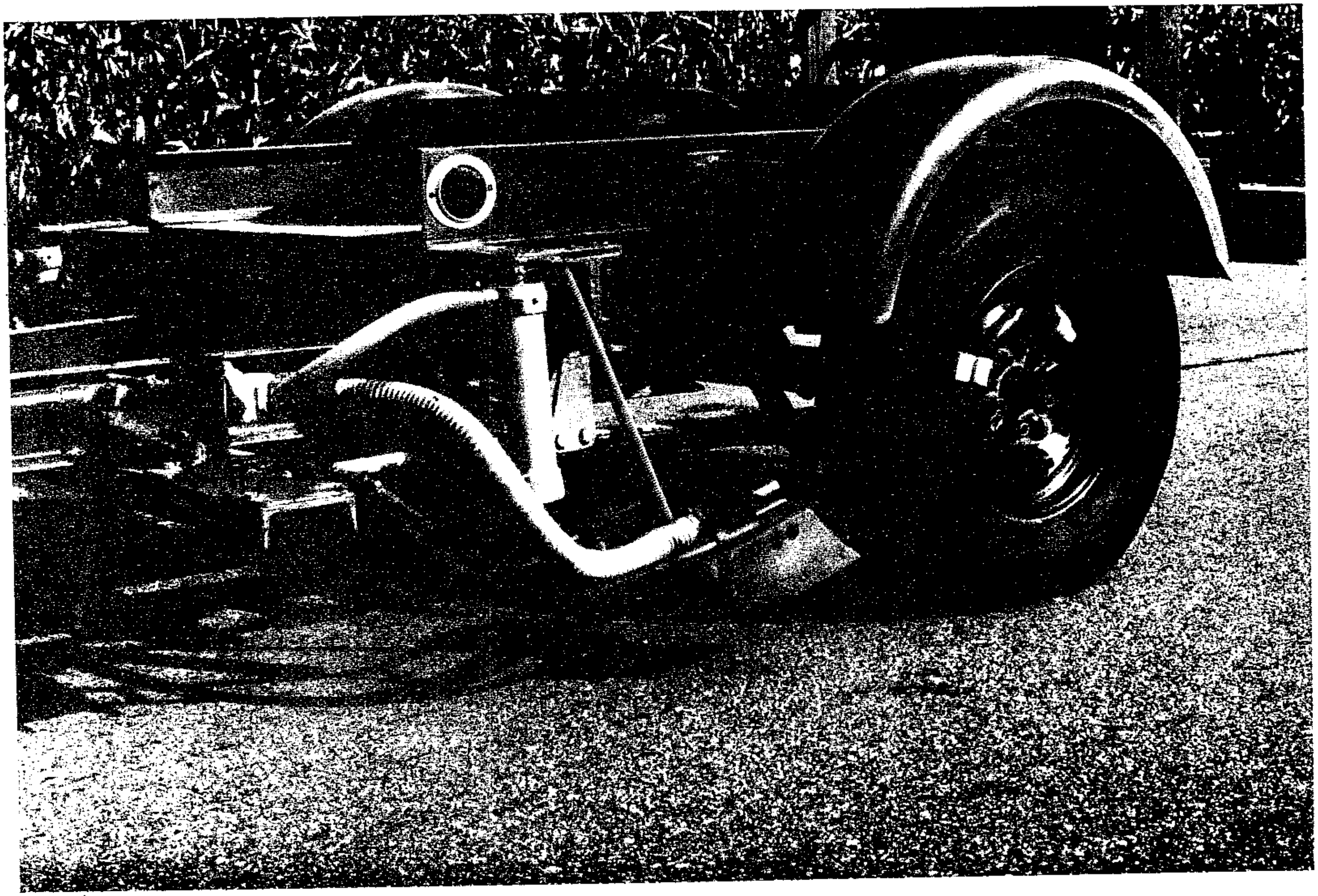


Figure 8. Modified watering system incorporating brush applictors.

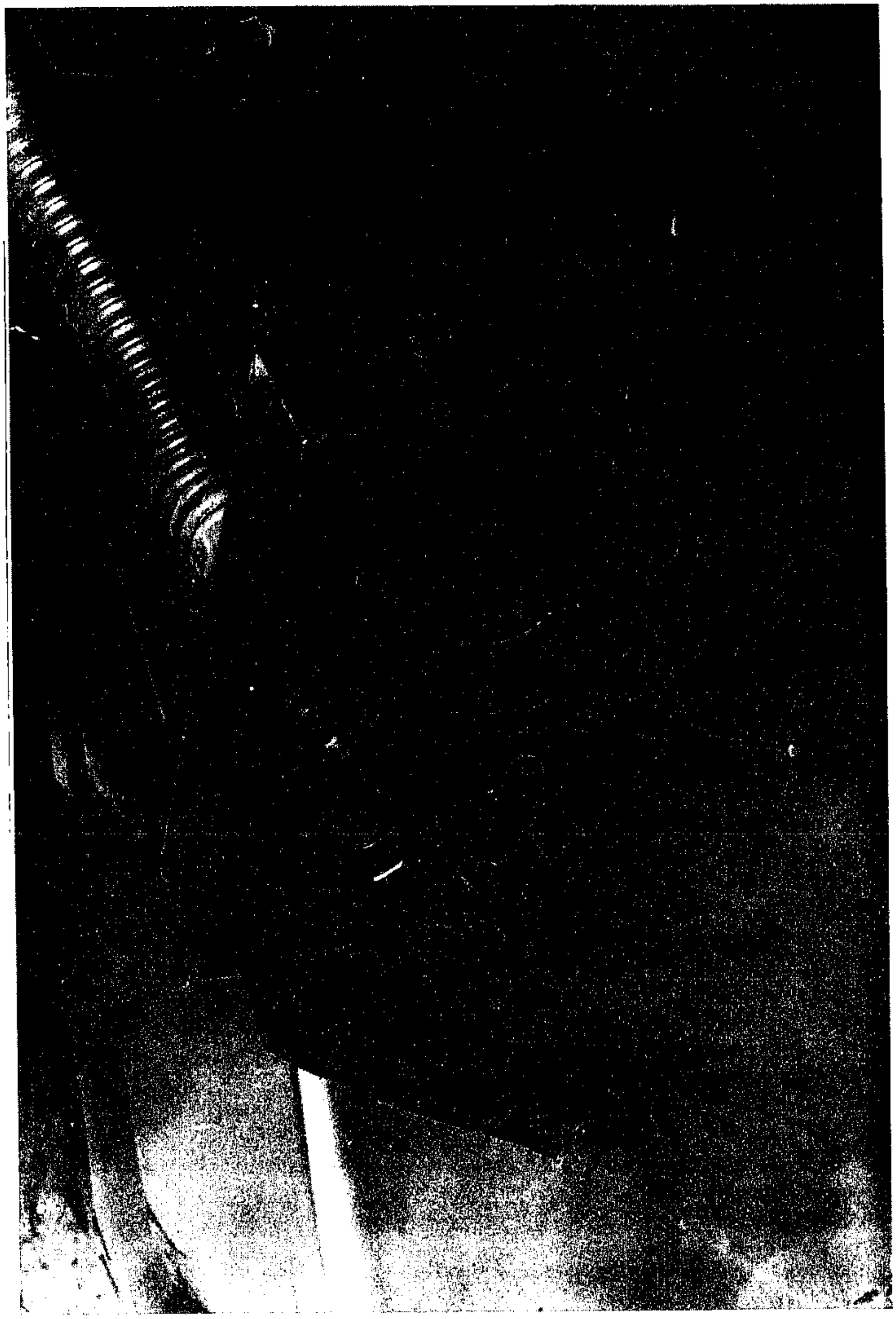


Figure 9. Brush applicator with side baffles.

of the brush as characterized by the soft nylon bristles was found highly satisfactory for extensive use as a water applicator for conducting skid tests. Little wear of the bristles was evident after a full year of testing which included over 5000 test applications. Visual observations indicated that the brush system is very effective in applying a uniform layer of water of measurable width to the pavement surface. The brush applicator tends to dissipate the energy of the water as it is discharged through the brushes. Consequently, the velocity or kinetic energy of the water is reduced to a manageable level for producing a more steady and uniform flow within the path of the test tire. By having greater control of the cross-sectional area, the water is more evenly distributed and largely concentrated within the working area of the test tire. One of the main advantages found for the brush system is the reduction in the amount of water needed to comply with the theoretical water layer thickness requirements of ASTM Designation: E 274-65T. Because the application of water was most consistent, resulting in a more efficient use of the water, the wetting system incorporating the use of brush applicators was selected as standard equipment for conducting skid tests on Illinois pavements.

During the development of the modified watering system, a series of tests was conducted to determine the skid number-water flow rate relationships for the three common methods of applying water during skid testing. The methods include: (1) application of water directly to the face of the tire by means of a nozzle; (2) application directly to the pavement by means of a nozzle; and (3) application directly to the pavement by means of a brush.

A total of 108 skid tests were performed with established flow rates of 13.5, 27, and 33 gpm for each water application system. The tests were conducted at 12 locations within a two-mile section of a new bituminous concrete surface with a constant test speed of 40 mph. Three test runs were made at each location, which provided a total of 36 tests for each of the established flow rates corresponding to each method tested. The surface texture of the pavement was considered reasonably uniform for making a valid comparison between the three methods of applying water. These tests were performed before the pump system was modified to produce a constant water flow rate as described previously. However, to minimize the variations in water flow rate relative to the condition of the battery, sufficient time was permitted between each test to recharge the battery.

The results of the water application tests based on the averaged skid value obtained for each condition are shown in Figure 10. A major point of interest is the wide difference in skid numbers obtained in the three methods of water application. The wetting system using brush applicators produced the lowest skid number for a given rate of water flow. This trend also was found when attempting to correlate skid data obtained by the Illinois trailer using the brush system with data acquired by trailers of other agencies using other application systems. In most cases, the skid numbers determined with the Illinois trailer have been consistently lower than corresponding values derived by the other agencies. Variations in skid number were also apparent when comparing systems utilizing brush applicators. These variances are believed to be influenced at least partially by dimensional differences in the location of the brush in front of the test tire. The configuration of the brush assembly is another possible cause of variability.

Recording System

Problems encountered with the recording system were: (1) unstable gain within the circuitry of the preamplifiers; (2) extensive fluctuations of the excitation voltage provided by the power supply; (3) undesirable signal-to-noise ratio in the recorded output; and (4) mechanical difficulties within the chart drive system.

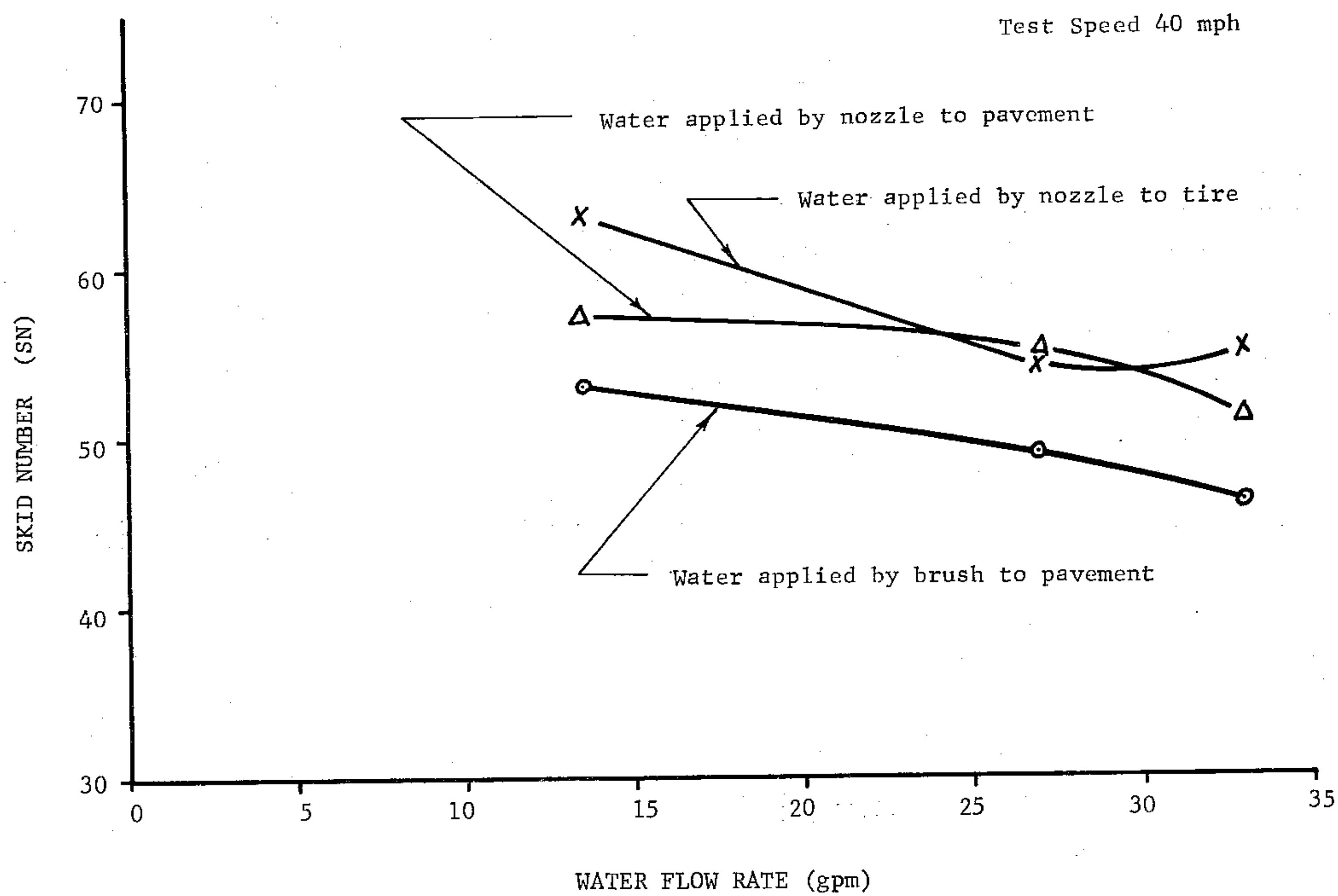



Figure 10. Comparison of water application methods.

Variation in the gain of the preamplifiers was corrected partly by replacing the temperature-sensitive, carbon resistors with metal-film precision resistors having a very low temperature coefficient. The stability of the preamplifiers was further improved by lowering the gain, or the ratio of increase of output over input, of the feedback circuit from 500 to 200.

After improving the stability of the system by reducing the gain of the preamplifiers, it was necessary to restore the total gain of the system to its original value. The recorder was found capable of operating at a higher gain level without affecting the stability of the system. The gain of the recorder, therefore, was adjusted to provide a total system's gain equivalent to the original equipment.

The excitation voltage originally was obtained from a small power supply which was shunt-regulated by a zener diode. This method of regulation was ineffective in producing a steady voltage to the strain gage transducers. The excitation voltage for the strain gages varied considerably with the output voltage of the truck battery. This deficiency was corrected by replacing the power supply with a transistorized, series-regulated unit which provides an output of 6 volts within the limits of $\pm$ 0.1 percent.

Excessive noise in the recording system was found to be generated by ground loops formed by the transducer cable shields. The signal-to-noise ratio was greatly improved by grounding one end of each shield to a common point. This arrangement lowered the noise level to a degree where it was no longer visible on the recorded data.

The recorder was furnished with a mechanical drive which was designed to provide a chart speed proportional to vehicle speed so that the test speed could be determined from the recording. During a skid test, the recorder chart drive is powered by an auxiliary speedometer cable which is attached to the take-off "Y" adapter installed at the point where the primary speedometer cable enters the truck transmission. The other end of the cable is attached to the gear reduction unit containing an electro-magnetic clutch.

With this arrangement, a mechanical difficulty was encountered with the clutch failing to engage and disengage properly because of the large torque required to overcome the inertia of the gear reduction unit. This deficiency was corrected by decreasing the gear ratio within the take-off "Y" adapter of the drive mechanism. With this modification, the electro-magnetic clutch functions at a higher speed with a lower torque. An additional gear reduction unit was installed to restore the chart drive to its original speed. A clutch was installed between the gear reduction unit and the recorder which allows the recorder drive to run electrically whenever desired without turning the gear reduction unit. The gear ratio of the system produced a paper speed of approximately 2.2 inches per second with the truck traveling 40 mph. Because a considerable amount of paper was consumed during a test with this chart speed, the gear ratio of the drive was revised to provide a paper speed of about one inch per second at a 40 mph test speed.

In an effort to insure a high degree of confidence in the recorded data, a calibration pulse representing a known torque was added to the recording system. This calibration pulse appears with each skid-test recording, and is automatically placed on the recording immediately after the brake is released (Figure 11). At this time, a relay is actuated which places a calibration resistor across one side of the Wheatstone bridge located in each torque transducer. The programer maintains the calibration for about one second, after which the relay is released and the programer is automatically reset and readied for another skid test.

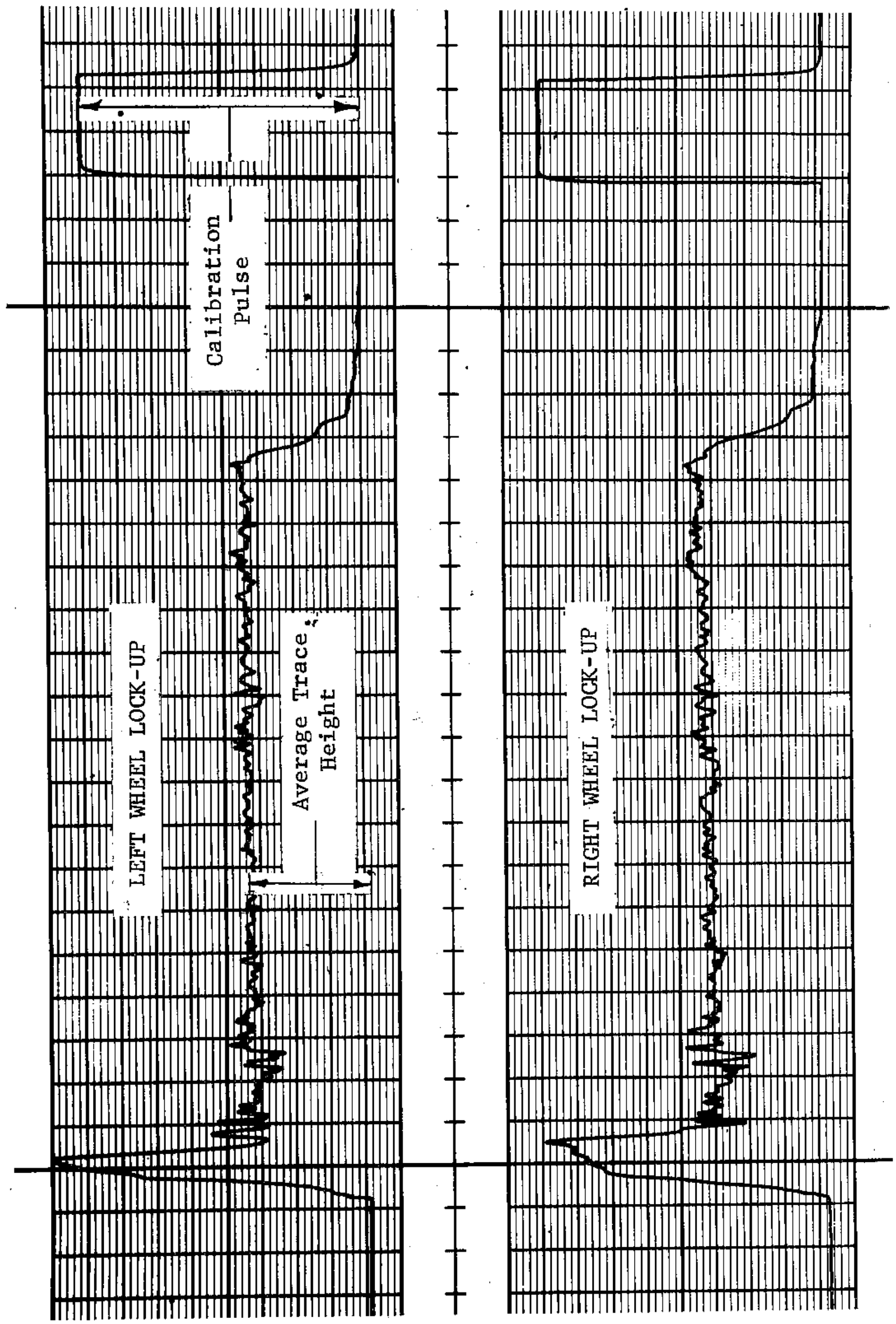



Figure 11. Typical sample of recorded data.

A chart coding system was constructed for the recorder utilizing the event markers supplied with the recorder. The month, day, year, and pavement test section were recorded in binary code on the edge of the strip chart. This feature later was dropped for two reasons. First, the code could not easily be checked for accuracy during the course of skid testing, and second, difficulties were encountered with the performance of the event markers in the recorder. This information is now manually written on the chart preceding the skid-test runs.

The timing sequence programed for a skid test also was revised to conserve water and to reduce the time required for the total test period (Figure 12). The application of water is now terminated immediately after releasing the locked brake.

The recording from each skid test presently is evaluated by visually reading the oscillograph trace. Because of the large number of tests required for this study, a considerable amount of time is consumed when processing the data in this manner. An automatic digital printout is being developed for recording the average transducer strain recorded during a test, the numerical value for the calibration pulse, and the vehicle test speed. With the use of the automated system, a substantial savings in time for data reduction will be realized and the results will be less dependent upon individual interpretation of the chart recordings. The analog recordings will still be produced along with the digital readout to detect any irregularities that may occur during a test and to provide a permanent analog record of the test data. Although this modification is not financed by funds for Project IHR-86, the feature will be used for the collection of data for the study.

Radio Communications and Safety Equipment

A Motorola MOTRAC FM four-channel, two-way radio was installed in the skid truck. The radio has the capability of transmitting either of the two-coded signals

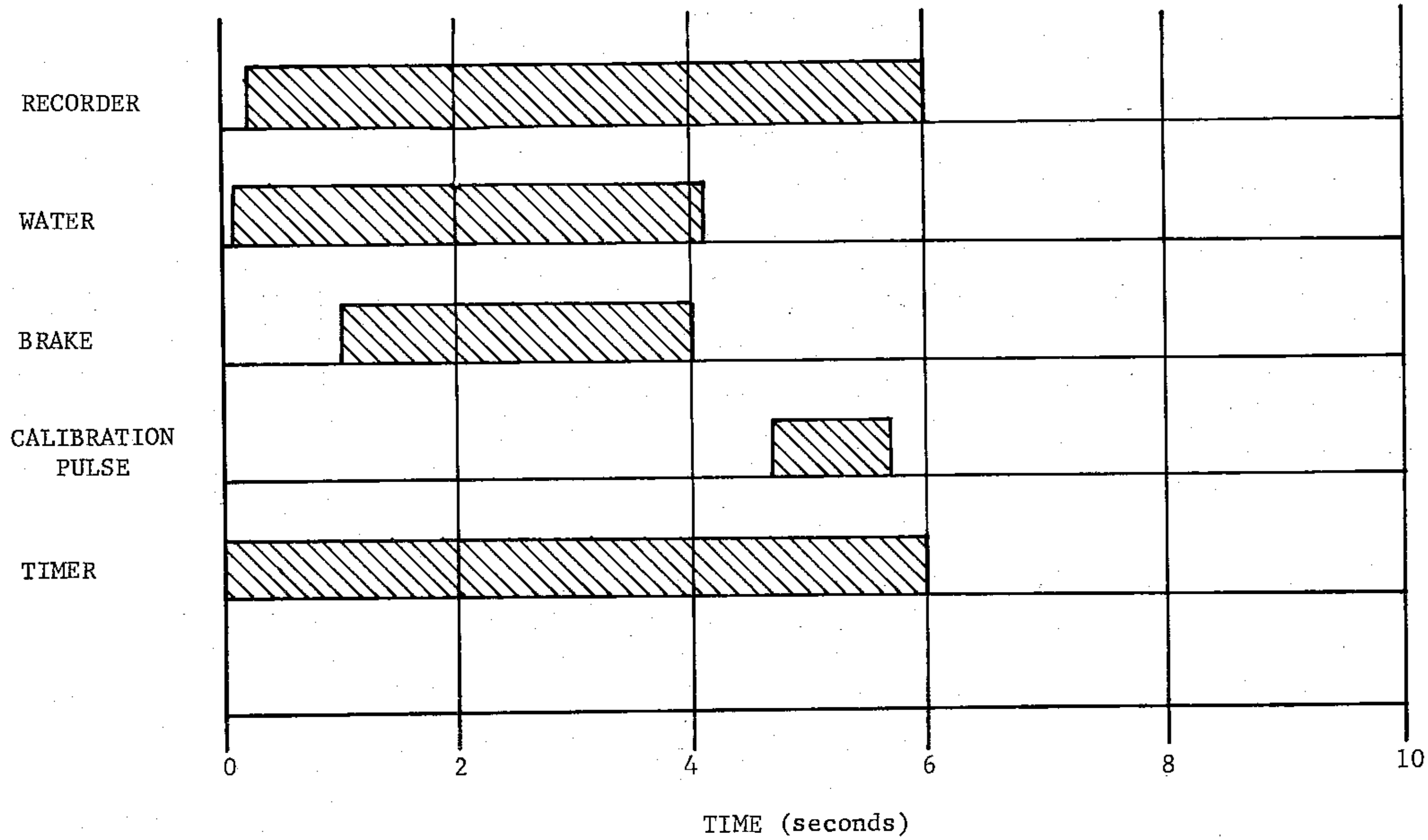



Figure 12. Revised timing sequence for skid test.

on any of the four channels. This enables the operator to communicate directly with the base stations located at the headquarters of each highway district. At some test sites, police assistance in traffic control is desirable, and this assistance can be obtained quickly through a radio call to the highway district headquarters from where the State Police are in turn notified.

Other communication equipment includes three RCA Personalfone-50 FM portable transceivers. These transceivers are four-channel units compatible with the mobile radio in the truck. They are used by the police and the flagmen at the test site to communicate with the skid-truck operator and to coordinate skid-test activities with traffic movement. The communications established with the transceivers improve the safety of the test operations by permitting the driver to be informed immediately of traffic hazards occurring at test sites where visibility is limited.

Because much of the skid testing is done in high-traffic-volume areas, the installation of additional warning lights on the truck cab and the skid trailer was deemed necessary. Two simultaneously flashing red lights were mounted on the front of the truck and two alternately flashing red lights were placed on the top corners of the sign frame on the skid trailer (Figure 13). A sign reading "SKID TEST VEHICLE" is located at the rear of the trailer. Four temporary warning signs and stands are carried on the tow vehicle and erected at each end of the test sites for the duration of the skid tests.

CALIBRATION

The following procedures are used for calibrating the watering system and the force measuring transducers to insure that the total system is functional prior to testing. Calibration of these components is made periodically and on occasions when the test results appear questionable.

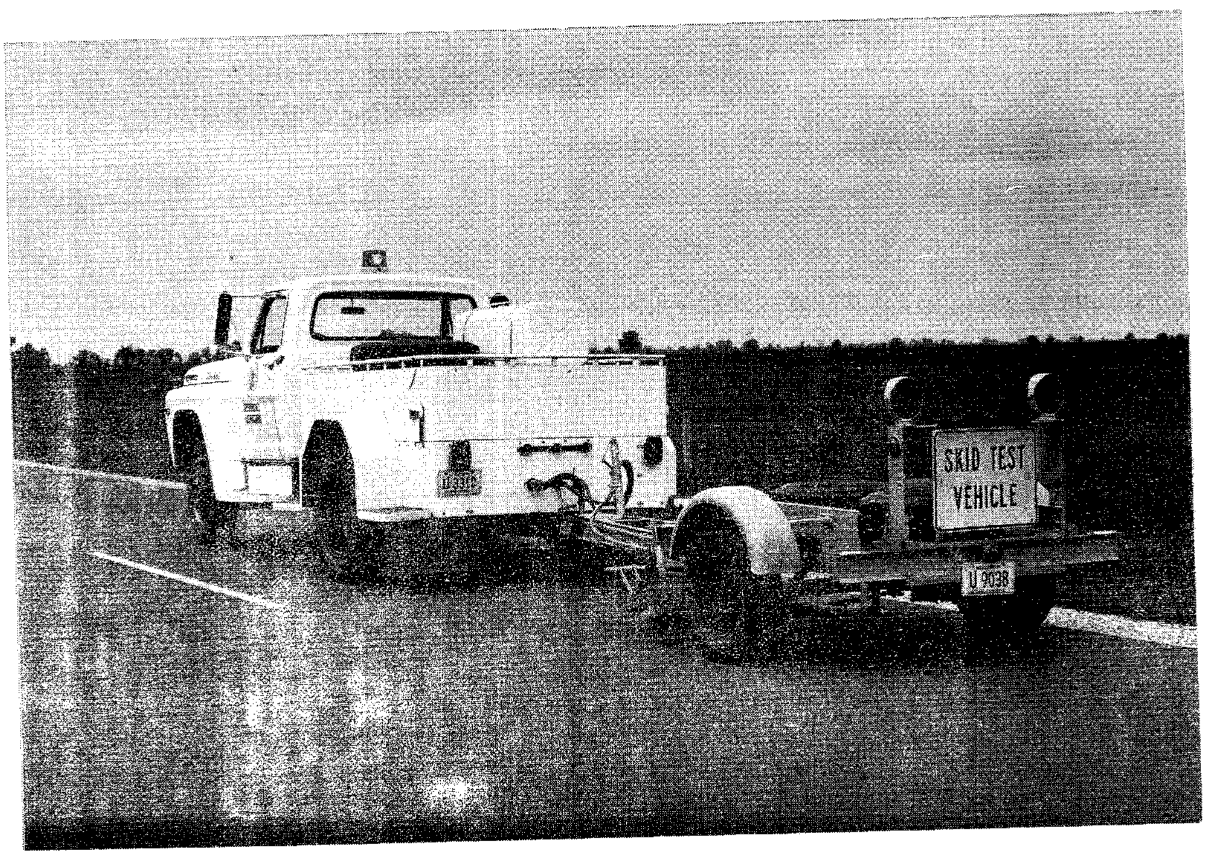



Figure 13.  Skid-test equipment with safety lights and signing.

of 40 mph, the measured discharge rates were 26.1 gpm at the left wheel and 24.4 gpm at the right wheel. These flow rates, with the valves at the brush applicators adjusted to provide maximum flow, are near the lower limit of the required discharge rate. The tests confirmed the direct proportionality between the water flow rates of the positive displacement pumps and vehicle velocity; therefore, no mechanical adjustment was necessary for maintaining the required flow rate at different test speeds.

Based on information received from the manufacturer, the water pumps were initially designed to produce a water flow rate of 31.0 gpm with the back pressure of 4.3 psi for a 40 mph test speed. The measured flow rates determined after installing the brushes indicated a reduction in flow rate of 4.9 gpm at the left wheel and 6.6 gpm at the right wheel. This decrease in water flow rates is mainly attributed to head losses produced within the piping from the pump outlet to the brushes and within the brush assemblies. Although the water flow rates are lower than originally planned, the thickness of the water layer falls within the limits specified by ASTM Designation: E 274-65T.

Transducer Calibration

The skid number for a pavement surface is determined by measuring the torque developed by the locked wheel during a skid test. This torque is measured by a torque-tube transducer mounted between the brake backing plate and a flange which is welded to the axle. Two two-gage rosettes are mounted on the top and bottom of each torque tube so that all of the forces are cancelled except torque. With strain gages on each transducer wired to form an electrical Wheatstone bridge, a shunt resistor can be placed across one arm of the bridge which unbalances the bridge as if a torque had been applied to the transducer. Therefore, any torque can be simulated by the selection of an appropriate shunt resistor.

A lever arm device is used to calibrate the torque transducer in lieu of the pull method suggested by ASTM Designation: E 274-65T. The experience of other investigators indicates that the use of the lever arm device reduced the time required to complete the calibration while maintaining a degree of accuracy equivalent to the pull method.

The lever arm is attached to a standard wheel rim which is mounted on the trailer axle in place of a conventional operating test wheel. After the trailer is raised and leveled, the brakes are locked, and increments of load are applied to the lever arm producing known increments of torque on the transducer. A strain indicator is used to identify the magnitude of the strains produced by the known torques. A calibration curve is plotted from the produced data from which values of torque can be obtained from corresponding measurements of strain.

From the torque-strain relationship, a calibration resistor was selected to simulate a strain which is equivalent to a known torque. By automatically switching the resistor across one arm of the Wheatstone bridge, a calibration pulse representing the known torque is recorded immediately after the end of the braking period. Since the torque applied to the locked wheels during a skid test is directly proportional to the height of the calibration pulse, the induced torque can be determined by comparing the average height of the recorded trace with the height of the calibration pulse. The measured torque is then converted to skid number by using the appropriate equation for either a single- or two-wheel lockup.

SUMMARY COMMENTS

To measure the relative skid resistance of pavement surfaces in Illinois, a two-wheel type skid trailer which uses the torque at the locked wheel as a measure of pavement skid resistance was developed according to the applicable portions of ASTM Designation: E 274-65T. The design of the original equipment was based on a review of available information regarding systems in use by various agencies throughout the country. During the review it became evident that little uniformity existed among the design cetails incorporated in the different systems. Therefore, a decision was made to include those design features which the experience of others had shown to be adequate or had at least indicated promise in providing satisfactory results.

After conducting preliminary skid tests, the need for certain modifications to improve the performance of the system became apparent. One of the major modifications made in the equipment involved the watering system. The primary purpose of the watering system is to simulate a wet pavement condition by applying a water layer to the pavement directly in front of the locked wheel during a skid test. For a water system to be most effective, the flow rate of the water discharged should be constant and the cross-sectional area of the water layer should be uniform.

The original equipment included an electrically powered water pump which operated from the battery of the tow vehicle. Preliminary tests of the original equipment indicated that the water flow rate discharged by the pump varied with the state of charge of the battery. Because of this variation, the electric water pump was removed and replaced by two positive displacement water pumps which are gear-belt driven by the drive shaft of the tow vehicle. The pump system as now modified produces a constant water flow rate which is directly proportional to vehicle speed.

From visual observations of the water discharged in front of each tire by the nozzle applicators, the width of the water trace was found inconsistent due to the turbulence and scatter of the water as the water stream was applied to the pavement surface. The water discharge apparatus was modified by adding brush applicators which provide a more uniform distribution of the water in front of the test tire. Rubber baffle plates also were added on each side of the brushes to further restrict the lateral displacement of the water trace.

The general guidelines for developing the watering system as outlined by ASTM Designation: E 274-65T are flexible in that a number of possible water applicator configurations are permitted provided the requirements for the thickness of the water layer are met. Comparative tests of three common methods of water application were conducted to evaluate the effect of the brush applicators when measuring the skid resistance of pavements. The methods compared were: (1) water applied by nozzle directly to the pavement; (2) water applied by nozzle directly to the tire; and (3) water applied by brush directly to the pavement.

This study has indicated that, by directly applying the water with a nozzle, it is extremely difficult to obtain a uniform water layer which even approximates the computed film thickness. A greater degree of uniformity was achieved, however, with the use of brush applicators which placed a water layer more consistent in both thickness and width. The test results also indicate that the skid values recorded were significantly different, depending on the method of application.

The flow rate of the watering system was calibrated to insure that the quantity of water applied to the pavement was sufficient. The measured flow rates of 26.1 gpm at the left wheel and 24.4 gpm at the right wheel are within the range of flow rates needed for depositing the specified water layer.

Revisions also were made to the recording system to improve the stability of the signal conditioning equipment. The recording system includes two DC preamplifiers, a strain gage excitation power supply, and a two-channel recorder.

Problems encountered with the recording system included: (1) unstable gain within the preamplifiers; (2) extensive fluctuations of the excitation voltage provided by the power supply; and (3) undesirable signal-to-noise ratio in the recorded output.

The unstable gain in the preamplifiers was corrected by replacing the temperature sensitive carbon resistors with precision resistors having a very low temperature coefficient, and by lowering the gain of the feedback circuit from 500 to 200. The overall system gain was maintained by increasing the gain of the recorder, which was capable of operating at a higher gain level without affecting the stability of the system.

The fluctuation in the excitation voltage was corrected by replacing the shunt-regulated power supply with a transistorized, series-regulated unit which was capable of supplying an output of 6 volts within ± 0.1 percent.

In order to determine the magnitude of the torques applied to the locked wheels during a skid test, the torque transducers were calibrated to establish a relationship between measured strains and the corresponding torques. A lever arm device was used to calibrate the torque transducers in place of the pull method suggested by ASTM Designation: E 274-65T. The lever arm method was selected because of its simplicity and accuracy in applying a known torque to the transducers. Our experience, as well as that of other investigators, has indicated that the use of the lever arm device reduces the time required to complete the calibration while maintaining a degree of accuracy equivalent to the pull method. During a skid test, a calibration pulse representing a known torque is produced for comparison with the recorded test data.

The effort put forth during this phase of the research was made in an attempt to develop a skid testing device which conforms to the ASTM guidelines and which facilitates the collection of meaningful data for establishing the relative skid resistance of pavements constructed in Illinois. Correlation studies of trailers utilizing different self-watering systems, inclusive of the variety of nozzle and brush configurations in use, have indicated large differences in recorded data when comparing the results derived by the trailers. Attempts at correlating the Illinois skid trailer with similar units developed by other agencies also have shown that the Illinois equipment consistently yields a lower skid number when testing the same section of pavement. From the results of these correlation studies and from preliminary tests using various wetting systems, there is every indication that a standard system for applying water to the pavement is needed before a meaningful comparison can be made with the variety of skid trailers now in existence.

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